smaller vehicles. Overall journey time for a typical four-mile commute would drop from 23 minutes under the large-bus system to 15 minutes with small buses, and to 12 minutes with vans. These reductions, aggregated for all transit users, outweigh the more than 80 percent increase in operating costs for bus services themselves.

The lower costs of the more frequent services are not only of benefit to current transit users; they also greatly enlarge the potential market of riders for whom using transit services, as against driving in cars, is attractive. For all transit systems shown, overall costs of comparable car trips exceed those for bus services by large margins. But most of that additional cost is in the form of fixed ownership costs, averaged over the cars' useful lives. Typically, a car owner's decision to drive or take a bus would be based not on these fixed costs but on costs that vary according to the decision--vehicle operating costs, transit fares, and time and convenience factors. Automobile operating costs for the four-mile commute used in the transit examples, allowing an average of 1.5 riders per car, would be in the range of \$30 to \$33 for each 100 commuters, and transit-time costs would be unchanged from the transit estimates of \$48 per 100.[4] This puts the in-vehicle journey cost for automobiles at around \$80 per 100 riders--comparable to the equivalent cost for all the bus examples. Using or not using the bus would then be attractive, provided the increment of time spent waiting for a bus to arrive and then stop for other passengers was at least offset by the time and costs for collecting and depositing co-riders at both ends of a car trip and parking. If these latter costs were more than just 40 cents a car, automobile users would find small bus and van services less costly; large bus services, however, would not be so attractive as driving until collection and parking costs rose to around 90 cents a car--high enough so that in many cities, parking and pricing policies could be decisive in the choice. *(See Box 5, in Chapter V, for one example.)* Similar estimates assuming that all commuters could travel in four-passenger carpools show that frequent transit services are likely to be attractive if collection and parking costs are more than \$2 a carload.

The calculations illustrated use a value of \$3 an hour to compute time costs. But the lower overall costs for high-frequency systems still hold for much lower estimates of the economic worth of commuters' time. At 1984

4. Estimates for automobile costs are taken from maintenance and fuel cost estimates for intermediate and compact cars. See Department of Transportation, *Cost of Owning and Operating Automobiles and Vans 1984*.

transit operating costs and under the conditions in the example, for instance, U.S. transit systems would operate more efficiently with small vehicles if riders' time was valued above $1.00 an hour, which is less than one-third of the present federal minimum wage and well below time values typically used in feasibility studies for federally aided investments.[5] The potential market for whom frequent-service transit is less costly is thus very large and not restricted to more affluent groups in the community.

Under federal policy for aiding the modernization of existing transit systems, however, transit system development has tended to move away from, rather than closer to, networks of high-frequency services. During the last transit boom of the 1940s, one-fifth of buses added to the fleet seated fewer than 30 passengers and a further one-third offered between 30 and 40 seats. By contrast, 55,610 out of 63,280, or nearly 90 percent, of all the buses added between 1965 and 1983 have seated 40 people or more. Federal grants through 1982 have been approved for the purchase of 1,590 60-foot so-called "articulated" buses (in effect, double buses linked by flexible joints), and 44,000 40-foot buses. At the same time, only 8,000 small buses and vans have been bought. The average capacity of U.S. buses in 1983 (including standees) was 58 riders.

The trend toward increased bus size has tended to erode, rather than enhance, mass transit's attractiveness relative to private automobile travel. Physical limits on large buses in narrow suburban streets and low average loads relative to capacity on some routes have led to reduced coverage of transit networks and to route combinations with reduced frequencies. During the 1940s, 40 percent of municipal streets were bus routes; now, bus networks offer only half that coverage. Bus fleets were sized at one bus per 1.7 miles of network; now the ratio is one per 2.3 miles. This factor, combined with a 20 percent drop in annual mileage per bus, means that, on average, bus services are now 40 percent less frequent.[6]

Nationally, only some 6 percent of workers use any form of public transport on journeys to and from work (buses, only 4 percent)--but 70 percent of such transit use occurs in the central areas of large cities. In these cities' suburbs, transit use on work journeys dips to 5 percent; in smaller

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5. The Urban Mass Transportation Administration, for example, suggests a value of $3 an hour for transit studies, and FAA argues for time values equal to average earnings. On this basis the FAA used $17.50 an hour (in 1980 prices) in estimating benefits for air traffic control modernization. CBO's reevaluation of the National Airspace Plan used $5.90 an hour (30 percent of average earnings).

6. Estimates based on data compiled by the U.S. Bureau of the Census.

towns, less than 1 percent use public transit. (*Table 5 shows trends in ridership in cities of different sizes since 1940.*) The main corridors of larger cities, particularly to and from downtown areas, have been able to integrate the large buses without loss of business. (Measuring the changes is complicated by a change in statistical definitions.) Transit patronage in cities of more than 500,000 population, where public transit retains a dominant role for downtown work trips, seems to have remained at around the same level from the mid-1950s through the mid-1970s; thereafter, it seems to have increased somewhat. In smaller cities, however, ridership is now less than half that recorded at the beginning of the federal assistance program, and only one-ninth that of the 1940s boom years.

The Outlook for Transit Systems

Information on transit modes used for work journeys indicates considerable potential for the development of public systems based on frequent, convenient services allowing trips between many suburban origins and destinations. The use of shared transport (transit and carpools) is as high as or higher than in downtown travel outside central areas when journey speeds are comparable with those for car drivers (see Table 6).

But the pattern of regulation of transit activities and the cost structure that has evolved in the now largely publicly owned industry pose formidable barriers to improving the efficiency of mass transit. First, in response to pressure to limit demands for subsidy, transit officials will be led to favor the type of transit services with the lowest vehicle costs--that is, large buses. This is because industry studies indicate that, with fixed, subsidized fares, revenues from more frequent services would cover less than half the extra cost, and they would therefore require increased public support.[7] Further, the extent of the fare subsidy, now 64 percent of costs nationwide, restricts the pool of potential riders who value the time savings from more frequent transit services highly enough to be willing to pay more for them. Because the overall cost of longer journeys appears low to commuters, threshold time values for potential riders willing to switch from subsidized large buses to more frequent, self-financing services are double or even triple those for an unsubsidized system. As a result, transit agencies would not only have difficulty raising fares to cover costs but also new firms would be deterred by a much smaller potential market for

7. See, for example, Econometrics, Incorporated, *Patronage Impacts of Changes in Transit Fares and Services* (Washington D.C.: U.S. Department of Transportation, September 3, 1980).

TABLE 5. TREND OF TRANSIT PASSENGER TRIPS CLASSIFIED BY POPULATION GROUPS, CALENDAR YEARS 1940-1983

Year	Heavy Rail	Surface Lines (In billions) 500,000 and Over	250,000-500,000	100,000-250,000	50,000-100,000	Less Than 50,000	Surburban and Other	Total Passenger Rides or Trips
				Total Passenger Rides a/				
1940 b/	2,382	5,611	1,710	1,329	967	379	719	13,098
1945	2,698	8,721	3,654	2,952	2,376	1,166	1,687	23,254
1950	2,264	6,649	2,563	2,024	1,689	930	1,126	17,246
1955	1,870	4,510	1,668	1,236	1,019	467	759	11,529
1960	1,850	3,865	1,175	891	714	297	603	9,395
1965	1,858	3,747	757	520	592	240	540	8,253
1970	1,881	3,265	662	428	494	175	428	7,332
1975 c/	1,673	4,488	356	281	72	101	N.A.	6,972
				Unlinked Transit Passenger Trips d/				
1980	2,108	5,206	409	310	90	112	N.A.	8,235
1981 e/	2,094	5,158	301	242	91	78	N.A.	7,964
1982	2,115	4,934	286	238	90	78	N.A.	7,741
P 1983	2,167	5,050	276	231	89	76	N.A.	7,889

SOURCE: American Public Transit Association.

NOTES: N.A. = Not Available. P = Preliminary. Table excludes automated guideway transit, commuter railroad, and urban ferry boat.

a. Total Passenger Rides from 1940 through 1975 based upon individual transit system data collection procedures.
b. From 1940 through 1970 transit systems assigned by population of headquarters city.
c. From 1975 through 1980 transit systems assigned by population of urbanized area based on 1970 United States Census of Population.
d. Unlinked Transit Passenger Trips beginning in 1980 based on data collection procedures defined by Urban Mass Transportation Act, Section 15. Series not continuous between 1975 and 1980.
e. From 1981 through 1983 transit systems assigned by population of urbanized area based on 1980 United States Census of Population.

their services. In addition, most cities restrict entry to transport service sectors, often to protect their subsidized public agencies; by so doing, they limit the chances that competition could stimulate changes in the structure of services.

If bus systems were indeed efficient, road capacity--hence overall mobility for any combination of road and bus investment--would be greater than under the current system. Substitution of more small buses for fewer large ones would not necessarily increase road congestion. Smaller vehicles are less intrusive. They may make fewer stops and carry more passengers, so that passenger-car-equivalent measures of traffic flows may be equal. Moreover, studies have shown that the road space freed by attracting riders

TABLE 6. PROFILE OF JOURNEYS TO WORK BY MODE OF TRAVEL AND LOCAL POPULATION SIZE, 1980

Mode	In SMSAs a/ Central Cities	In SMSAs Outside Central Cities	Outside SMSAs	Total U.S.
Carpool				
Millions of Users	4.1	7.1	5.8	17.0
Speed (in miles per hour)	28.3	33.1	37.2	33.5
Public Transportation				
Millions of Users	4.0	1.8	0.2	5.9
Speed (in miles per hour)	12.6	18.1	19.0	14.7
All Shared Transport				
Millions of Users	8.1	8.9	6.0	22.9
Speed (in miles per hour)	18.5	28.3	36.3	26.6
Automobile, Sole Occupant				
Millions of Users	13.7	25.0	17.3	56.0
Speed (in miles per hour)	28.1	32.0	33.5	31.5
All Modes, Including Others Not Listed				
Millions of Users	23.5	35.8	25.3	84.7
Percent shared	34.0	25.0	24.0	27.0

SOURCE: Congressional Budget Office based on data provided by the U.S. Bureau of the Census.

a. Standard Metropolitan Statistical Areas.

from private cars to public transit generates new trips that tend to fill up the roads until the original "tolerable" congestion level is restored.[8] Without adding to delays for existing users, more frequent bus services, by attracting drivers out of their cars, free road space for new tripmakers. This is a clear gain in mobility.

Were transit efficient, fares would be higher, but services faster and more convenient. Moreover, cities could build fewer roads to accommodate any increase in traffic. But under current regulations, estimating the extent of this effect is difficult, because transit operators have no incentive to offer fast and frequent services in competition with the subsidized ones the cities provide. No market test of the value of increased trip making can be made to help in comparing mobility against transit and road costs. But simplified estimates indicate that the potential savings are large. If mass transit's share of urban travel had not declined during the 1970s, for example, urban road systems could (according to CBO estimates) have handled current traffic levels with something like $3 billion to $4 billion less a year (in 1983 prices) in capital investment.

8. See Peat Marwick Mitchell & Co., *BART's First Five Years: Transportation and Travel Impacts* (Washington, D.C.: U.S. Department of Transportation and U.S. Department of Housing and Urban Development, April 1979).

CHAPTER V

INCENTIVES FOR USERS: THE ROLE OF PRICES

Beyond nomination and evaluation, a third important aspect of an infrastructure management system is the incentives the system provides to its participants. This chapter addresses the incentives provided to infrastructure users; the next examines the incentives to program managers.

An infrastructure management system may correctly nominate and evaluate projects, but it will not contribute to economic growth and productivity unless it provides the right signals to govern users' access to infrastructure facilities. Universal free access to roads, ports, or mass transit would lead to their overuse and rapid deterioration. Charging a price greatly in excess of costs would lead to underuse and reduce the productivity of the infrastructure investment. Thus, prices are the key to providing infrastructure users with the incentives to use facilities efficiently.

HOW PRICING CAN SHAPE DEMAND

Users influence the amount of infrastructure services provided through the demand they express. Demand influences options for system development in two ways. The first is simple wear and tear: the greater the demand on highways, for example, the sooner the highways will wear out. The second emerges in "spillovers," or interactions among users or between users and nonusers: for example, heavy congestion erodes the quality of transport service a highway offers. Further, users can raise the overall social cost of the system when, for example, use of a system causes pollution.

In managing the use of infrastructure services, pricing is a primary tool. Federal management systems that pay insufficient attention to how services are used and priced, that fail to encourage efficient internal organization of infrastructure agencies, or that are seen to provide earmarked independent sources of finance for certain agencies or programs can create incentives that work against program aims.

Infrastructure Pricing

If infrastructure investments are to reflect national priorities, the incentives the management system gives to users should reflect national goals.

While the attention of many analysts and decisionmakers regularly focuses on cost recovery--that is, on charging rates that can fully defray federal costs--a major concern from a managerial perspective is that the prices set encourage efficient use.[1] Efficient use results when the person deciding whether or not to use a given service values it at whatever it costs to provide the specific increment of service he or she seeks. If the price is too low, overuse will result, causing undue wear and tear, congestion, pollution, or all three combined. If the price is too high, facilities will lie idle, with resources diverted to purposes that are less desirable from a national perspective.

For pricing to promote national goals effectively, managers must take into account all costs associated with the use of services. Such costs have several dimensions. The midday driver, for example, imposes less cost than does the rush hour traveler, because of congestion and pollution differences. Car trips are less costly than truck trips because cars cause less wear and tear on pavement. Failing to charge for the spillover costs, or adjusting charges poorly for differences in costs among users, creates incentives that distort users' demands relative to their costs. Undercharging general aviation (mostly small aircraft), for instance, encourages overuse of airport facilities; this creates the appearance of need for new or larger airports. Overcharging, on the other hand, and thus charging more than the direct costs (including spillovers), suppresses demand that could otherwise pay for the resources used. The flat-rate cross-subsidy systems some managers favor in pricing such services as urban transit, for example, tend to raise prices above cost on those parts of the system where services are less costly or more attractive than competing services; they do so in order to subsidize below-cost prices on more costly, less competitive sectors. Such a pricing system thus tends to reduce use where it is most efficient, and to expand use where it is not. As a result, cross subsidization destroys the advantages of any service relative to those others offer.

Though the relationship between pricing to manage use and pricing to recover costs can be complex, in most cases practical difficulties are relatively minor. The complexity can arise because many infrastructure systems involve large capital investments. These high fixed costs are difficult to allocate to diverse users, and difficult to recover without unduly suppressing use. In practice, however, charging efficiently for all costs, including spillovers, will usually raise enough revenue to recover high capital investment costs--so long as managers do not overbuild. Scale economies that might otherwise make it difficult to recover capital costs from users

1. For analysis of potential cost recovery for seven infrastructure services, see Congressional Budget Office, *Charging for Federal Services* (December 1983).

are fairly quickly eaten up by rising costs from congestion among users or other spillovers. In most infrastructure systems, the price that promotes efficient use (that is, the price that recovers the overall costs, including spillovers, of the last unit of service) is then also sufficient to recover the cost of operations and upkeep that the infrastructure agency incurs. Thus, the principle that prices should encourage efficient use is generally not inconsistent with the equity principle that users pay that is embodied in the cost-recovery principle.

A special case occurs if investment mistakes have resulted in overbuilding. Then, requiring a sound financial position for the agency charged with managing or operating a system--say, a port or turnpike authority--may necessitate charging users more than the price that maximizes the efficient use of the assets. The alternative would be to provide direct subsidies to cover revenue shortfalls. Both courses risk inefficiencies--on the one hand, those of suppressing or diverting use to other systems through overcharging, and on the other of administrative inefficiencies arising because of slacker cost management in subsidized agencies. Pricing in that case might follow "second best" rules, which attempt to apportion overhead costs among different users and services in ways that minimize distortions from the goal of efficient use of facilities.

A general difficulty in making optimal use of pricing for managing infrastructure systems is that prices in the public sector are generally more closely scrutinized and less responsive to changing market conditions than are prices in private markets. Public sector pricing usually requires elaborate procedures for setting costs, undergoing review, and receiving approval. The costs of making and changing prices for infrastructure services are not trivial, and changes in both the level and structure of these prices are usually infrequent. (*Table 7 shows how user fees are applied in federally supported infrastructure programs.*) In few programs have user fees (levied at all governmental levels) thus far assisted in infrastructure priority setting.

Reflecting Costs in Prices. The structure of highway taxes comes closest to a comprehensive price system, in that it attempts to relate taxes paid to the extent of actual use and to the extent of road damage resulting from that use. But current practice also undertaxes heavy trucks (those above 55,000 pounds gross vehicle weight) for the road damage costs they cause.[2/] It also ignores large spillover costs to other drivers, particularly

2. Comparisons of highway excise tax payments relative to allocable highway costs, including an option labeled DOT4 that is similar to the tax structure subsequently enacted in the Highway Revenue Act of 1984, are given in U.S. Department of Transportation, *Alternatives to Tax on Use of Heavy Trucks* (January 1984).

TABLE 7. CURRENT USER FEE OBJECTIVES IN FEDERALLY AIDED INFRASTRUCTURE PROGRAMS

	User Fee Objectives					
Program	Recover Federal Costs a/	Recover Total Government Costs b/	Recover Spillover Costs c/	Fees Varying With Use d/	Low Fees e/	No Fees f/
Highways	X	X	X	X	--	--
Airports	X	X	--	--	--	--
Air Traffic Control	--	--	--	--	X	--
Conrail	--	X	--	X	--	--
Amtrak	--	--	--	--	X	--
Coast Guard	--	--	--	--	--	X
Ports	--	X	--	X	--	--
Inland Waterways	--	--	--	--	X	--
Mass Transit	--	--	--	--	X	--
Municipal Water	--	X	--	X	--	--
Multipurpose Dams	--	--	--	--	X	--
Wastewater	--	X	--	X	--	--

SOURCE: Congressional Budget Office.

NOTES: All objectives categories refer to specific taxes levied on users rather than to general revenue sources applied to program financing.

a. Fees levied are tied directly to federal program levels.

b. Besides any federal levies, fees are charged by state or local authorities to recover their costs. Most such activities are managed by public authorities or public corporations.

c. Reflect the costs imposed by users on other users, or by users on nonusers.

d. Fees set so that users' payments reflect their overall consumption of the services.

e. Fees deliberately set to subsidize use. This category is the converse of column b/.

f. Neither federal nor local agencies levy fees for the use of these services.

those who contend with congested traffic. It may also rely too much on annual taxes (registration fees) or one-time taxes (on vehicle purchases) to be effective in influencing automobile use in particular, and too much on systemwide collections to influence use of particular facilities, especially urban streets. 3/

User fees in the form of tolls may sometimes bring road prices closer to the comprehensive cost level. 4/ The costs imposed by automobiles on congested urban streets, in terms of the delays imposed on other drivers and pollution from exhaust emissions for example, can be around 10 to 20 times the gas-tax rate. 5/ But these high costs would apply only on limited corridors and at certain times. Toll-based rather than tax-based prices can more easily be tailored to reflect such cost variations.

Among public enterprises, only two apply enterprise-like pricing policies: Conrail, operating in the newly competitive long-distance freight market, and ports, feeling the impact of competition through changes in trade patterns and cargo volumes. Conrail operates as a firm in the marketplace. Ports invite firms (shipping companies, terminal operators, freight forwarders) to provide services in different areas of the port in competition with each other, with each in turn charging for the services it provides to ship and cargo owners. Rents and general charges on shipping, meanwhile, usually cover port authority overheads. By contrast, in the federal irrigation schemes in western states, prices are typically fixed in long-term contracts at amounts that will recover around one-tenth of supply costs. 6/

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3. Evidence on this latter point has been assembled by the Urban Mass Transportation Administration Technical Assistance program, which has sponsored special programs for encouraging use of high occupancy vehicles by favorable parking pricing schemes. See Urban Mass Transportation Administration, *Parking Pricing Management*, Washington, D.C. (October 1984).

4. For consideration of other aspects of toll financing, see Congressional Budget Office, *Toll Financing for U.S. Highways* (December 1985).

5. A 40-minute car commute, for example, that off-peak could be undertaken in 20 minutes, say, would consume about 0.9 gallons of gasoline, for an average tax payment (state and federal) of just over 17 cents. The 20-minute delay assuming 1.5 occupants, would cost between $1.50 and $2.50 at values of time between $3 and $5 an hour. Ratios of waiting time to gas taxes would then be between 9:1 and 15:1.

6. The Reclamation Reform Act of 1982 (Public Law 97-293) provides that water districts that do not renegotiate contracts by March 1987 will face paying fees that recover full federal cost for water delivered to farms larger than 160 acres (320 for a married farm couple). Renegotiation, however, would allow districts to deliver water at current rates to farms up to 960 acres. The overall effect on water prices is thus unclear.

An Example of Spillovers: "Congestion Pricing"

Airports are another example. The value of landing slots varies with time of day. Landings at the most popular times are valuable because they make the best use of travelers' time. At some airports, airlines wish to operate more flights at these times than airports can handle efficiently. But airport pricing typically does not consider this.[7] Because airport fees do not ration slots, the Federal Aviation Administration enforced during the 1984-1985 winter a system of capacity quotas at the six busiest airports, under which airlines and other carriers were assigned arrival and departure times during peak operations.

Studies have shown, however, that infrastructure is more efficiently used when its use is regulated through pricing rather than quotas. In airports, the gain in efficiency results because flights that value certain arrival or departure times are able to outbid flights for which other times or even other airports (in the case of transferring traffic, for example) are equally suitable. Thus, the limited peak capacity is made available to the most valuable operations.[8] A study of FAA quotas at St. Louis in 1981, for example, shows that centralized allocation of slots has increased the losses from flight cancellations caused by capacity restrictions by between $7 million and $25 million a year (in 1981 dollars), depending on policies for allowing new entrant airlines access to peak times, over those that would have occurred if slot trading had been allowed.[9] Further, the study shows substantial costs to air transport that would remain after slot trading of about $12 million a year compared with costs without capacity limits. In other words, airlines would be prepared to pay $12 million for extra flights

7. From April 1, 1986, DOT rules permit some slot trading of Washington's National Airport, New York's La Guardia and John F. Kennedy Airports, and Chicago's O'Hare Airport. The appropriateness of this trading is to be debated in the Congress.

8. If slots were sold to the highest bidder, some small and medium-sized communities may lose air service because airlines serving them are unable to acquire slots at destination airports. In that case, it may be more efficient to sell slots in separate pools that assure that these communities continue to receive service, if a market based pricing system were established. See, for example, Severin Borenstein, *On the Efficiency of Competitive Markets for Operating Licences*, Institute for Policy Studies Discussion Paper No. 226 (Ann Arbor: The University of Michigan, September 1985).

9. Donald Koran and Jonathan D. Ogur, *Airport Access Problems: Lessons Learned from Slot Regulations by the FAA, An Economic Policy Analysis*, Bureau of Economics, Staff Report to the Federal Trade Commission (May 1983).

at the restricted times, an effect completely masked by quotas. Prices set to manage use, therefore, provide reliable signals on when expanding capacity is needed. In the St. Louis case, investing up to $85 million in capacity expansion would be economically justified, if capacity limits were permanent.[10] In Singapore, however, a system of permits, fees, and other mechanisms was devised to deal with peak-hour road conjestion (see Box 7).

The failure to use pricing as a tool for U.S. infrastructure management seems inconsistent with the rationale for public support for provision of the services. The persistent failure to incorporate spillover effects in pricing illustrates the types of inefficient choices made attractive by inadequate pricing. When ports and airports fail to use pricing systems that encourage ships and aircraft to employ facilities in the sequence that reflects the value of the terminal services to them, it raises handling costs and inflates apparent investment needs. Further, if pollution control costs are not included in prices charged, prices for some goods will generally be lower than the system cost, including pollution damage. As a result, the production of the goods with polluting side effects is encouraged relative to nonpolluting activities, and the apparent need for pollution-control measures expands. This last effect is particularly evident when one compares progress made during the 1970s in controlling air pollution through a system of internalizing more spillover costs through lower subsidies for emission control devices, with the outstanding backlog of about half the wastewater treatment plants originally estimated as needed under a subsidy scheme operating in the same period that allowed communities virtually to escape costs. Thus, regulation can be an efficient substitute for capital programs in inducing users to take account of external costs in choosing their uses of infrastructure when these are difficult to price.

10. The benefit of avoiding the $12 million a year cost for canceling 85 flights and rescheduling other flights to meet capacity restrictions would provide a 12 percent return on an $85 million investment with a 15-year life. Minimum losses under the quota system of $19 million a year would appear to justify a $140 million investment at the same 12 percent return.

BOX 7
PRICING INFRASTRUCTURE USE--
ROAD PRICING IN SINGAPORE

Since June 1975, entry to Singapore's main downtown area during the morning rush hour has been restricted to buses and drivers displaying special licenses. The licensing scheme was introduced to avert the burgeoning of severe congestion in the main business and shopping district. Its introduction was preceded by a year-long public information program, and was supplemented by steep increases in parking fees and the availability of park-and-ride services based on new fringe area parking lots. In the first year, all morning traffic was reduced by 40 percent with automobiles down 70 percent. Vehicle occupancies increased significantly, while bus transit improved its share of commuters from 33 percent to 46 percent; about half of the cars entering downtown carried four or more passengers instead of just one. The scheme also had the effect of stretching the peak period and diverting through traffic. Air pollution and safety risks fell, and the license system has been judged to have had positive environmental effects.

National effects were also positive. To date, the scheme is a financial success. Revenues from license sales are enough to cover all operating costs and provide a net return of about 10 percent on the small investment made (just under $3 million, spent mainly for fringe-area parking lots). At the same time, the overall growth in gasoline consumption has fallen from 6.4 percent annually between 1970 and 1975 to 3.8 percent a year.

Managers of the licensing scheme have confronted three important issues. First, without a precedent, planners faced the risk that the fee they chose would be too high or too low. Initially, it did indeed prove to be higher than needed. Planners had aimed to set license fees to reduce peak-hour traffic by 25 percent to 30 percent, including a 50 percent reduction in automobiles. This would have equated peak and off-peak flows. The scheme far exceeded this objective. During the scheme's first several years, downtown streets were significantly underused. Managers judged, however, that long-term changes in attitudes toward automobile commuting were more important than short-term efficiency gains, and they did not lower the fee. As inflation eroded the effect of the fee, downtown streets absorbed a 24 percent increase in automobile traffic between 1975 and 1980 without exceeding the scheme's traffic-management objectives.

Second, probably because of substantially different trip purposes, reductions in the morning rush hour (principally journeys to work) were not matched by lower evening peaks, which include a substantial proportion of trips for shopping, dining, and other leisure purposes. Without harming businesses in the downtown area, however, there seemed to be no way of imposing restraints on evening traffic, and no solution was found.

Finally, though readily accepting public transit and carpools, Singaporeans made little use of the park-and-ride services. Occupancy of the parking lots was as low as 6 percent. Shuttle buses were quickly redeployed to supplement mainline services, and alternative uses found for the land devoted to carparks.

SOURCE: For further information, see Peter L. Watson and Edward P. Holland, *Relieving Traffic Congestion: The Singapore Area Licensing Scheme,* World Bank Staff Working Paper no. 281 (Washington, D.C., June 1978), and The World Bank, *World Development Report 1981* (New York: Oxford University Press, August 1981).

CHAPTER VI

INCENTIVES FOR MANAGERS: PROMOTING NATIONAL GOALS

This chapter discusses the incentives that the federal infrastructure management system provides for program managers. Federal and local managers often have few incentives to manage infrastructure programs in ways that further national goals. Federal managers responsible for the broad shape and coverage of programs rarely adapt their programs to changing conditions, nor do they make real trade-offs between existing programs and new opportunities. Thus, while circumstances change, many federal programs remain static.

On another level, federal aid provides state and local infrastructure managers with two important incentives. First, nonfederal governments tend to regard federal grants-in-aid as generally similar to their own, nonfederal, revenues, and therefore, have the incentive to substitute them for their own resources. Thus, the increase in infrastructure spending that follows federal aid is commonly much less than the amount of that aid, because states and localities do not expand their spending by the added amount. Second, important federal subsidies are provided through tax exemptions for local borrowing to finance projects, and though investments financed this way usually involve careful attention to project choices, states and localities--not federal managers--have control over the sizes of the subsidies and the nature of the projects financed, and may have little incentive to use this subsidy to meet national objectives.

MANAGING PROGRAM EVOLUTION

Federal infrastructure management policies must offer program managers incentives to change programs as new circumstances require. Most infrastructure programs are of long duration, and their managements must therefore be responsive to changing community needs and issues. (*A Canadian initiative for encouraging innovation in government programs is described in Box 8.*) At first sight, the federal highway program appears to have been much more innovative than other programs. Activities

BOX 8
INCENTIVES FOR PROGRAM MANAGERS--CANADA'S ENVELOPES FOR POLICY AND EXPENDITURE MANAGEMENT

The government of Canada developed an "envelope" system for controlling expenditures that forces bids for capital investment to vie directly against one another. The envelope system effectively separates expenditure control from policy development. The former is exercised in scrutiny by the Treasury Board (comparable to the Office of Management and Budget) of spending under approved programs; the latter is managed by sectoral policy committees of the Cabinet. All projects proposed for financing from the policy reserve are examined first by the Treasury Board, then by a policy committee's professional staff, which independently analyzes proposals competing for limited policy reserve funding. Cabinet ministers then rank new proposals, approving those of greatest rank, until the policy reserve is exhausted. The bases on which plans compete are their identifications of needs, analyses of options, and appraisals of investments.

All governmental programs are grouped into policy sectors, and each sector is assigned a limited total, or envelope, of resources. Allocation of resources within each policy sector is managed by a committee of the Cabinet. Envelopes normally include a current policy level (or A-base) budget and a policy reserve (the B-base) of around 10 percent for new initiatives, including capital projects. Departments within any sectors assigned a negative policy reserve

attracting federal highway assistance have broadened and changed over time. Federal activities in aviation or water resources, however, are now broadly the same as they were in 1960. The highway program has incorporated three entirely new initiatives for federal assistance--highway and traffic safety in 1966, bridge reconstruction in 1972, and rehabilitation of state and local networks in 1974 and of the Interstate system in 1976.[1]

1. Highway and traffic safety programs were first included in Public Law 89-563; the bridge reconstruction program dates from Public Law 91-605; aid for rehabilitation of state and local networks was just authorized under Public Law 93-643; and aid for resurfacing of interstate highways more than five years old dates from Public Law 94-280.